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SOURCE REGISTRATION

Philadelphia Refinery

Philadelphia Energy Solutions
Refining and Marketing LLC
3144 Passyunk Avenue
Philadelphia, PA 19145-5299
215-339-2000

Hand Delivered

November 13, 2012

Mr. Edward Wiener
Chief, Source Registration
Air Management Services
321 University Avenue
Philadelphia, Pa. 19104

Re: Philadelphia Refinery; Plan Approval Application for Adjustment of Eight Process Heater Firing Limitations With Crude and Product Increases

Dear Mr. Wiener:

Attached please find three copies of a Plan Approval Application that updates the submittal made on August 31, 2012. This incorporates data corrections and principles discussed over the last several weeks.

Very Truly Yours,

Charles D. Barksdale, Jr.
Manager, Environmental Department

gcf
File: RACT Adjustment Application. & AMS Correspondence 2012

Discussion

Sunoco Philadelphia Refinery
Update to Plan Approval Application for Adjustment of Certain Heater Firing Limitations From 25 PA 129.92 (RACT)

Summary

Sunoco Inc. (R&M) (Sunoco) owns and operates a petroleum refinery in Philadelphia, Pennsylvania[1]. This consists of multiple processing areas, the Girard Point Processing Area (GP) near the Platt Bridge, the Point Breeze Processing Area (PB) located near the Passyunk Avenue Bridge, and operations at Marcus Hook. The Philadelphia Sunoco refinery is made up of a number of processing units that are employed in the overall process of converting crude petroleum and other hydrocarbon feed stocks into finished hydrocarbon products and petrochemicals. Products include gasoline, home heating oil, diesel fuel and others.

This updated application for a plan approval (original submitted August 31, 2012) will facilitate increased production at the Philadelphia Refinery as part of a strategic plan to shift crude oil refining operations within the single source that is the Philadelphia and Marcus Hook Refineries. On August 7, 2012, the Pennsylvania Department of Environmental Protection ('PADEP") issued an amendment of the Title V permit for the Marcus Hook Refinery and Philadelphia Air Management Services ("AMS") issued an administrative order relative to the Title V permit for the Philadelphia Refinery recognizing that the two locations were a single source for the reasons set forth therein. Sunoco's retirement on August 15, 2012, of the permits for operating crude refining sources at the former Marcus Hook Refinery implemented the plan to shift that production to the Philadelphia Refinery as a part of the shutdown of crude refining operations at the Marcus Hook Refinery.

Sunoco (the Refinery) submitted this plan approval in order to allow the Philadelphia Refinery to accommodate this increased production, as it is integral to the project to increase the firing limitations of the eight process heaters and to raise refinery crude feed and product rates by proportionate amounts in order to achieve this increased production. The Refinery' August 31, 2012 application is contemporaneous with the surrender of the permits for crude refining at the Marcus Hook Refinery and the filing on August 15, 2012 for the emission reduction credits for the shutdown. Consequently, the crude-refining shutdown at the Marcus Hook Refinery and this eight process heater increase at the Philadelphia Refinery constitute a single project. The shutdown sources at the Marcus Hook Refinery include:

- 12-3 CRUDE Heater H-3006;
- 17-2A H-01, H-02, H-03 Heater;
- 12-3 CRUDE DESULF Heater;

[1] The Sunoco Philadelphia Refinery is now owned and operated by Philadelphia Energy Solutions Refining & Marketing, LLC (PES).

- 15-1 Crude Heater;
- 17-2A H-04 Heater; and
- Marcus Hook Cooling Towers including the 10 Plant A and B, 12 Plant North and South, 17-1A, 17-2, 17-2A and LSG towers.

All of the Philadelphia Refinery processing units rely on the combustion of gaseous fuels (refinery by-product gas and natural gas) in combustion units (direct fired process heaters and steam producing boilers) to provide the energy needed to drive hydrocarbon conversions and product separations. By this application, the Refinery is proposing to shut down the Marcus Hook sources listed above and increase the hourly firing limits on eight of its process heaters by an average of 12%. This will allow the Refinery to process, on average, more crude into finished products.

The target heaters proposed for increases at the Philadelphia Refinery are shown in Table 1 below.

Table 1: Proposed Firing Limits

Process Unit	Heater	Existing Hourly Firing Limit, MMBtu/Hr	Proposed Hourly Firing Limit, MMBtu/Hr
GP Unit 137 Crude	F-1 Crude Heater	415.0	460.0
PB Unit 210 Crude	H101 Crude Heater	183.0	192.0
PB Unit 210 Crude	H-201A/B Crude Heater	242.0	254.0
PB Unit 865 HDS	11H1 Feed Heater	72.2	87.3
PB Unit 865 HDS	11H2 Reboiler Heater	49.9	64.2
PB Unit 866 HDS	12H1 Feed Heater	43.0	61.2
PB Unit 868 FCCU	8H101 Recycle Heater	49.5	60.0
GP Unit 231 HDS	B101 Feed Heater	91.0	104.5

No physical changes are required to accommodate the increase in firing rates. In addition, this application shows that no change is required to existing NO_x controls through a RACT analysis per 25 PA code §129.92.

For the Philadelphia Refinery proposal above, emissions are estimated to increase from the above heaters. These emissions increases are balanced by concurrent reductions from the shutdown of Marcus Hook units described above. As a result, there are no significant emissions increases pursuant to attainment (PSD) and non-attainment (NANSR) new source review. The total project emissions, as well as the PSD emissions analysis table and the NANSR 5-year and 10-year contemporaneous emissions netting analysis tables for ozone are provided below.

Overall Methodology for Emissions Calculations

In this permit application, the emissions from the eight heaters and ancillary units were calculated using the methodology described below.

This project will not require any physical change to the eight heaters or any other ancillary units at the refinery. The emissions changes associated with the heaters are attributed to the incremental change in firing rates from historic operation to that projected for the future. Similarly, the emissions increases associated with the ancillary units are attributed to potential incremental increase in crude throughput in the future.

The emissions changes from the emission units are calculated through a step-wise process. Initially, the emissions changes are calculated as the difference between the baseline actual emissions (BAE) and the future projected emissions. As per 25 Pa Code §127.203a(a)(4)(i) and 40 CFR §52.21(b)(48), BAE was estimated as the highest annual average during any 24-month period in the five years preceding the project. Similarly, the projected actual emissions were estimated as the maximum emissions that the project sources are projected to emit in any 12-month period during the five years following the project.

In addition to the emissions increase calculated above, the Refinery also calculated the emissions increases that the ancillary project sources could have accommodated in the baseline 24-month period. As per 25 Pa Code §127.203a(5)(i)(C) and 40 CFR 52.21 (b)(41)(c), the Refinery excluded any increase in emissions from sources affected by this project that could have been accommodated in the 24-month period representing the baseline period, and that are unrelated to the project from the project emissions increase[2]. The Refinery based this determination on available EPA guidance. Specifically, on 18 March 2010, EPA Region IV issued a letter to Georgia Pacific[3], where EPA concurred with Georgia Pacific that the "highest demonstrated average monthly operating level during the baseline period" could be used as an approximation for the level the unit could have accommodated during the baseline period.

Thus, the Refinery calculated the emissions the ancillary project sources were capable of accommodating in the baseline period based on a review of monthly average unit operations for the ancillary project sources during the baseline 24-month period so that these emissions could be accounted for (subtracted from) future projected emissions

Discussion of Emission Increases at Target Process Heaters

Emission increases from the eight target heaters are summarized in an Attachment C.

The most important data for the target heaters is the future annual firing rate. All pollutant emission changes refer to the future annual firing rate as compared to the past actual annual firing rate which is calculated from the actual firing in the two most recent years – 2010 and 2011. The annual average hourly firing rate (MMBtu/hr) for the heaters is projected to be significantly lower than the projected hourly firing rate (MMBtu/hr) operating for the duration of the year. Therefore, the projected annual averaged firing rate (MMBtu/year) is estimated assuming, for most of the heaters, that the future hourly firing rate will be the old firing hourly limit plus 50% of the increase between the new hourly firing limit and the old hourly firing limit multiplied by the full 8,760 hours in a year. It is unlikely that the refinery would be able to achieve this rate for every heater. Thus, all the emission change associated with the project represents the difference between past actual emissions and future projected emissions. Note that the Refinery did not account for the emissions increase from the heaters that could have been

[2] The demand growth exclusion was applied only to the ancillary units and not to the eight heaters covered in this project. Therefore, the emissions increase estimated in this application is conservative (higher).
[3] USEPA, 2010. Letter from Gregg M. Worley, Chief- Air Permits Section, USEPA Region IV to Mark Robinson, Georgia Pacific Wood Products LLC, re: PSD Emissions Calculation and Demand Growth; 18 March 2010.

accommodated in the baseline period; therefore, the emissions increase for the heaters presented in this application is conservative (higher). The sections below discuss the methodology for calculating the emissions for this project for each pollutant.

Primary Pollutants VOC, $PM/PM_{10}/PM_{2.5}$, CO

The Refinery has used AP-42 factors for these pollutants for annual emissions and other reports, unless CEMS data are available. The AP-42 factors are based on a natural gas heat content of 1,020 Btu per cubic foot higher heating value (Btu/CF HHV). Based on refinery gas testing data, the Refinery has historically converted the AP-42 lb/MMSCF factor to a lb/MMBtu factor by dividing the AP-42 factor by the current BTU/CF HHV value for refinery fuel gas. Firing records kept as MMBtu/year are then easily multiplied by the lb/MMBtu AP-42 equivalents to obtain the emissions in units of pounds.

Primary Pollutant SO_2

SO_2 has historically been estimated based on actual sulfur in fuel gas. For this project, the 2011 actual SO_2 emissions and actual fired rates for the each target heater were used to derive a heater-specific SO_2 emission factor. This emission factor was multiplied by the future annual firing rate to determine the emissions in units of pounds.

Primary Pollutant Greenhouse Gas as CO_2e

The Philadelphia Refinery annually reports GHG emissions to the EPA as required by the Mandatory Greenhouse Gas Reporting rule. The GHG emission factors used for this project were derived following the methods described in 40 CFR 98 Subpart C for General Stationary Fuel Combustion Sources, which includes an analysis of the composition of the refinery fuel gas being combusted for each heater. The GHG emission factor for each heater was derived from the reports to EPA for the year 2011. This method is at least as accurate as the AP-42 emission factor for CO_2 as this factor only reflects the combustion of natural gas.

Primary Pollutant NO_x

The methodology used to select the NO_x emission rates for the eight heaters is described below. As seen below, the NOx emission factors for some heaters used in the project emissions calculation were based on RACT permit limits as opposed to AP-42 emission factors used in the annual emissions reports. The Refinery proposes to amend annual emission reports submitted to AMS for 2010 and 2011, for heaters where the annual emissions used in this analysis are different from that reported earlier. The calculation spreadsheet is attached to help understand the adjustments discussed below.

For F-1 Heater, the 24-month baseline is the average of the actual Emission Inventory (EI) emissions for 2010 and 2011. The future actual NO_x is the future annual firing rate times a NO_x factor of 0.123 lb/MMBtu, which corresponds to the average NO_x emission rate used in the 2011 annual emission report.

For Unit 210 H101 heater, a NO_x emission rate used in this analysis was 0.089 lb/MMBtu, which corresponds to the NO_x RACT limit. The emission rate used in the annual EI was based on a conservative emission rate published in EPA's AP-42 emission factors, which is higher than the RACT limit for the heater. As per 25 Pa Code §127.203a, the baseline emissions for a source could not exceed the applicable emissions limit. Therefore, the baseline actual emissions and the future projected emissions for the heater were based on the RACT NO_x emission limit.

For Unit 210 H201 Heater, the BAE was based on the average CEMS data for the years 2010 and 2011. The future NO_x emission rate was based on the permit limit for the heater of 0.03 lb/MMBtu.

For Unit 865 11H1 Heater, the BAE was based on the RACT NO_x limit of 0.133 lb/MMBtu, which is lower than the AP-42 emission factor used in the annual EI, as the baseline emissions could not be greater than an applicable emissions limit. Future NO_x emissions are based on the RACT emission rate.

For Unit 865 11H2 Heater, the use of AP-42 data was specified by AMS for use in the annual emissions report over the applicable RACT NO_x emissions limit. To be conservative, the Refinery used the NO_x RACT limit for the heater, which is greater than the AP-42 emission factor, to calculate the baseline emissions for the project. The Refinery proposes to amend the 2010/11 EI's to reflect the higher emission factor of 0.113 lb/MMBtu for the heater. Projected NO_x emission rate for the heater was based on the NO_x RACT limit as well.

For Unit 866 12H1 and 868 8H101 heaters, the baseline emissions and the future projected emissions were established using the same approach as that used for 865 11H2 heater.

Finally, for Unit 231 B101 Heater, the baseline is shown as adjusted to recognize that this heater has a RACT NO_x emission factor of 0.122 lb/MMBtu. Future NO_x is based on this same RACT limit times the future annual firing rate.

Discussion of Primary Pollutant Increases at Other Ancillary Project Sources Except Heaters/Boilers and Target Heaters

Please see the Attachment D. This shows all pollutants except greenhouse gases. The emissions increase associated with other ancillary project sources, except heater and boilers, was calculated based on a projected increase in crude throughput over the baseline 24-month period. The expected increases in crude processing related to the target heater firing duty increases is estimated at 115% of the baseline. The Refinery used this scaling factor for emissions for units where scaling is appropriate. Some sources (such as LDAR VOC emissions) are not appropriate for scaling because the emissions of VOC are not rate dependent. The tank VOC emissions are a different exception in that only tank working losses will increase with increased throughput. Typical light hydrocarbon (gasoline) tanks emit 96% through the seals and only 4% of losses are due to throughput. The overall increase factor is therefore 1.006 times base emissions for an average 115% of base product increase ($0.96 + 0.04 \times 1.15 = 1.006$).

As discussed above, any emissions increase associated with the other ancillary project sources, which the units were capable of accommodating in the baseline period and which are unrelated to the project, were excluded from emissions increase associated with the project.

Discussion of Primary Pollutant Increases for Non-Targeted Heaters and Boilers

Please see Attachment E for this set of sources. Future emissions are mostly estimated by ratioing at the average crude increase. The exceptions are for the crude heaters at the crude units experiencing the increases, where the specific crude unit throughput ratios are used. The Refinery also excluded emissions increases that the units were capable of accommodating in the baseline period and which are unrelated to the project, as discussed for the ancillary sources.

Discussion of Greenhouse Gases Except at Target Heaters

Please see Attachment F. All estimates are in metric tons as GHGe. The historic data is from reporting for the years 2010 and 2011. The baseline GHGe are ratioed for crude throughput increases depending on whether the source is a specific crude unit heater, or a source that is affected at the average crude increase. The emissions associated with LDAR are not rate dependent and will not cause an increase. Also, tank VOC emissions will only increase at the margin due to working loss increases at the factor of 1.006 times the base emission rate.

A summary of emissions change associated with the project for all pollutants is presented in Table 2.

Table 2: Total Project Emissions

Source	Pollutant (TPY)									
	NO_x	SO_2	CO	VOC	PM	$PM_{10}/PM_{2.5}$	H_2SO_4	Lead	HAP	CO_2e
Target Heater Emissions	130.7	2.9	121.4	7.9	10.9	10.9	0.0	0.0	0.0	138,731
Ancillary Emissions	26.1	1.7	42.1	7.4	3.3	3.3	0	0	0	51,237
12-3 CRUDE HTR H-3006 Reductions	-89.5	-0.1	-70.4	-4.6	-6.4	-6.4	---	---	---	-92,084
17-2A H-01, H-02, H-03 HTR Reductions	-57.0	-0.1	-41.2	-2.7	-3.8	-3.8	---	---	---	-44,912
12-3 CRUDE DESULF HTR Reductions	-6.1	0.0	-5.1	-0.3	-0.5	-0.5	---	---	---	-4,819
15-1 Crude Heater Reductions	-136.5	-0.2	-77.2	-5.1	-7.0	-7.0	---	---	---	-111,102
17-2A H-04 HTR Reductions	-6.2	0.0	-5.2	-0.4	-0.5	-0.5	---	---	---	-8,250
Marcus Hook Cooling Tower Reductions	---	---	---	-19.9	-10.2	-10.2	---	---	---	---
Total Project Emissions	**-138.5**	**4.2**	**-35.5**	**-17.8**	**-14.2**	-14.2	**0.0**	**0.0**	**0.0**	**-71,200**

Note: PM_{10} and $PM_{2.5}$ is assumed to be equal to PM.

PSD Emissions Analysis

A summary of the PSD emissions analysis for the project is presented in Table 3. As seen from the table, the emissions change for all PSD regulated pollutants including SO_2, NO_2, PM, PM_{10} and CO is estimated to be less than the corresponding significant emission rates. Therefore, the project does not trigger the PSD requirements. In addition, since the GHG emissions from the project do not exceed 75,000 TPY of CO_2e, GHGs is not considered a regulated pollutant for the project.

Table 3: PSD Emissions Analysis

Emissions	Pollutant (TPY)							
	NO_2	SO_2	CO	PM	PM_{10}	H_2SO_4	Lead	CO_2e
Project Emissions Change	-138.5	4.2	-35.5	-14.2	-14.2	0.0	0.0	-71,200
PSD Significant Level	40	40	100	25	15	7	0.6	75,000
PSD Triggered (Before Netting Analysis)	No	No	No	No	No	No	No	No

NANSR Emissions Analysis

The Philadelphia County is considered nonattainment for ozone (and its precursors – NO_x and VOC) and fine particulate matter ($PM_{2.5}$) (and its precursors - NO_x and SO_2). Therefore, the project is evaluated for applicability to NANSR regulation for ozone and $PM_{2.5}$, as codified in 25 Pa Code §127.203 and §127.203a, respectively. The results of the NANSR emissions analysis for precursors to ozone (NO_x and VOC) are presented in Table 4. As seen from the table, the emissions increase from the project is calculated to be less than the significant emission rate of 25 TPY for both NO_x and VOC. In addition, as suggested by AMS, the Refinery conducted a NANSR emissions netting analysis, as per 25 Pa Code §127.203(b)(i) and (ii); the results of which are summarized in Tables 5 and 6, respectively for the 5-year and 10-year netting analyses. As seen from these tables, the net increase in emissions from the project is estimated to be less than the significant emission rates for both pollutants. Therefore, the project will not trigger the requirements of NANSR for NO_x and VOC.

Table 4: NANSR Ozone Emissions Analysis

Project	NO_x (TPY)	VOC (TPY)
Project Emissions Change	-138.5	-17.8
NANSR Significance Level	**25**	**25**
NANSR Review Required	**No**	**No**

Table 5: NANSR Ozone 5-Year Emissions Analysis

Project	5-year NO_x (TPY)	5-year VOC (TPY)
Project Emissions Change	-138.5	-17.8
Contemporaneous Increases	10.3	1.1
Net Emissions Change	**-128.2**	**-16.7**
NANSR Significance Level	**25**	**25**
NANSR Review Required	**No**	**No**

Table 6: NANSR Ozone 10-Year Emissions Analysis

Project	10-year NO_x (TPY)	10-year VOC (TPY)
Project Emissions Change	-138.5	-17.8
Contemporaneous Increases/Decreases	16.7	20.2
Net Emissions Change	**-121.9**	**2.5**
NANSR Significance Level	**25**	**25**
NANSR Review Required	**No**	**No**

The results of the emissions change associated with $PM_{2.5}$ and its precursors are presented in Table 7. As seen from the table, the emissions increase from the project is expected to be less than the significant emission rate for $PM_{2.5}$, SO_2, and NO_x. As per 25 Pa Code §127.203a(a)(2), emissions netting analysis is not required to be conducted for de minimis emissions increases of $PM_{2.5}$ and its precursors. Therefore, the project will not be subject to the NANSR requirements for $PM_{2.5}$ and its precursors.

Table 7: NANSR $PM_{2.5}$ Emissions Analysis

Project	SO_2 (TPY)	NO_x (TPY)	$PM_{2.5}$ (TPY)
Project Emissions Change	4.2	-138.5	-14.2
NANSR Significance Level	**40**	**40**	**10**
NANSR Triggered (Before Netting Analysis)	**No**	**No**	**No**

Discussion of Retro RACT Analysis

Please refer to the Appendix 1. Because no new equipment is being installed, no existing equipment is being physically modified, and neither PSD nor NANSR is being triggered, there are no regulatory reasons to add new controls to the target heaters undergoing firing increases. Three of the target heaters however, are proposed to have new hourly firing limits that put them over the firing capacity for heaters that were determined in 1999 by RACT analysis to be presumptively controlled by combustion tuning rather than physical controls. These heaters are Unit 865 11H2, Unit 866 12H1, and Unit 868 8H101. Some might question whether these heaters unfairly missed an important control analysis. In the Appendix is shown a retro-RACT analysis for each of these heaters, plus, for completeness purposes, for Unit 210 F-1 (large heater) and for 231 B101 and 11H1. As discussed below, there are no heaters that would have been determined to require controls in 1999, other than combustion tuning. Upgrading control efficiencies to today's standards (notably for SCR and ULNB) is shown to not change this conclusion. Obviously, using today's inflated costs would also not change any conclusions.

For the 11H2, 12H1, and 8H101 units, capital costs were developed for the listed control techniques and factored to 1999 values (Nelson-Farrar Inflation Index). O&M costs for 1999 are based on similar sized heater analyses. Control efficiencies of the 1999 period were used, except that for SCR the current efficiency of 85% was substituted. Then a second case was constructed using today's efficiencies and 1999 costs, the most stringent case. One exception from 1999 analysis is that heaters that burned oil in 1999 (11H2, 12H1) were not analyzed with oil in the base emissions. No heater in the Philadelphia Refinery today burns oil. It is assumed that had oil burning elimination been a study case for RACT, that step would have been consider and taken if necessary. In any event that step has positively been taken and is no longer a consideration. In no case is anything other than combustion tuning indicated. Target heaters F-1, 11H1, and B101 were also retro-studied with the same kinds of assumptions. These also show no change of conclusion from 1999. Three heaters were not given the retro-analysis. The Unit 210 H101 heater already had ULNB control in 1999 and it was determined than that SCR and FGR did not physically fit the plot plan, so no other meaningful options existed. Unit 210 H201A/B has NO_x control today at a permit limit of 0.03 lb/MMBtu, and no further control would be indicated in a retro-analysis.

Proposed Permit Limits

As discussed above there are no changes in this proposal that lead to a new regulatory requirement other than limitations that will assure the basis for the presented emissions changes. All the pollutant emissions changes are below significance levels for PSD and NANSR. The recommendations below are proposed to limit emissions:

- Unit 167 Heater F-1 shall be limited to 460 MMBtu/Hr and 3,767,000 MMBtu on a rolling 365 day basis
- Unit 210 Heater H101 shall be limited to 192 MMBtu/Hr and 1,643,000 MMBtu on a rolling 365 day basis
- Unit 210 Heater 201A/B shall be limited to 254 MMBtu/Hr and 2,120,000 MMBtu on a rolling 365 day basis
- Unit 865 Heater 11H1 shall be limited to 87.3 MMBtu/Hr and 699,000 MMBtu on a rolling 365 day basis
- Unit 865 Heater 11H2 shall be limited to 64.2 MMBtu/Hr and 500,000 MMBtu on a rolling 365 day basis
- Unit 866 Unit Heater 12H1 shall be limited to 61.2 MMBtu/Hr and 456,000 MMBtu on a rolling 365 day basis
- Unit 868 Heater 8H101 shall be limited to 60 MMBtu/Hr and 480,000 MMBtu on a rolling 365 day basis
- Unit 231 Heater B101 shall be limited to 104.5 MMBtu/Hr and 856,000 MMBtu on a rolling 365 day basis